REMARKS

The specification has been amended to correct errors of a typographical and grammatical nature. Due to the number of corrections thereto, applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. The substitute specification includes the changes as shown in the marked-up copy and includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The claims and abstract have also been amended to more clearly describe the features of the present invention.

Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (Case: Case: 501.42956X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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SUBSTITUTE SPECIFICATION

LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a liquid crystal display device.

Various types of a liquid crystal display device are known. To take a lateral field type liquid crystal display device as an example, in pixel regions formed on a liquid-crystal-side surface of one substrate of a pair of substrates, which are arranged to face each other in an opposed manner while sandwiching liquid crystal material therebetween, pixel electrodes and counter electrodes are formed, and the optical transmissivity of the liquid crystal is controlled in response to an electric field that is generated between respective electrodes.

Further, with respect to an active matrix type liquid crystal display device to which the above technique is applied, on a liquid-crystal-side surface of one substrate, respective regions, which are surrounded by gate signal lines which extend in the x direction and are arranged in parallel in the y direction and drain signal lines which extend in the y direction and are arranged in parallel in the x direction, are defined as the above-mentioned pixel regions and a switching element is provided be each pixel region.

A video signal from the drain signal line is supplied to the pixel electrode by way of the switching element, and, at the same time, the switching element is turned on in response to a scanning signal received from the gate signal line. Further, a signal which becomes a reference with respect to the video signal is supplied to counter electrodes in each pixel by way of counter voltage signal lines, for example.

This liquid crystal display device can produce a display of a good quality having a favorable contrast, and it also has so-called wide viewing angle characteristics.

SUMMARY OF THE INVENTION

When the definition of the liquid crystal display device is increased and the distance between lines becomes short, the probability of occurrence of drawbacks, such as the disconnection of signal lines (for example, drain signal lines or the like) or short-circuiting with other signal lines is increased in the manufacturing stage. Further, in the lateral field type liquid crystal display device, due to the fact that strip-like counter electrodes and pixel electrodes are alternately arranged and the like in each pixel region, the distance between electrodes or the distance between the electrode and the line is relatively finely formed; and, along with such relatively fine molding, the probability of occurrence of drawbacks, such as the disconnection of signal lines (for example, drain signal lines or the like) or short-circuiting with other signal lines is relatively increased in the manufacturing stage, thus giving rise to the tendency that the so-called yield rate is lowered.

Since the disconnection or the like of one signal line will bring all of a group of pixels related to the signal line into a display failure condition, it is necessary to perform repairing, such that the disconnection or the like of one signal line causes a display failure of only one pixel, for example.

The present invention has been made in view of such a circumstance; and, it is an object of the present invention to facilitate the repair of a liquid crystal display device.

A summary of typical aspects of the invention disclosed in the present

application is as follows.

(1) A liquid crystal display device is formed of a pair of substrates with a liquid crystal layer disposed therebetween, at least a first conductive layer formed on one of said pair of substrates, at least a first insulating layer formed on the first conductive layer, a plurality of drain signal lines formed on the first insulating layer in overlapping relation to the first conductive layer, at least a second insulating layer formed on the drain signal line, at least a second conductive layer formed on the second insulating layer and elongated substantially along the drain signal line in overlapping relation to the drain signal line, wherein the second conductive layer is spaced from the overlapping region of the first conductive layer and the drain signal line.

(2)A liquid crystal display device is formed of a pair of substrates with a liquid crystal layer disposed therebetween, a plurality of gate signal lines and at least a first conductive layer formed on one of said pair of substrates, at least a first insulating layer formed on the gate signal line, a plurality of drain signal lines formed on the first insulating layer and crossing the gate signal line, at least a second insulating layer formed on the drain signal line, wherein the first conductive layer is elongated substantially along the drain signal line and has a portion overlapping the drain signal line, at least a second conductive layer formed on the second insulating layer and elongated substantially along the drain signal line in overlapping relation to the drain signal line and the first conductive layer, wherein the width of the second conductive layer at the overlapping region of the drain signal line and the first conductive layer is smaller than the non-overlapping region of the drain signal line and the first conductive layer.

(3) A liquid crystal display device is formed of a pair of substrates with a liquid

crystal layer disposed therebetween, at least a first conductive layer formed on one of said pair of substrates, at least a first insulating layer formed on the first conductive layer, a plurality of drain signal lines formed on the first insulating layer in overlapping relation to the first conductive layer, at least a second insulating layer formed on the drain signal line, at least a second conductive layer formed on the second insulating layer and elongated substantially along the drain signal line in overlapping relation to the drain signal line, wherein the second conductive layer has a hole at the overlapping region of the first conductive layer and the drain signal line.

The present invention is not limited to the above-mentioned constitutions and various modifications can be made without departing from the technical concept of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a diagrammatic plan view and Fig. 1B is a section taken along line b-b in Fig. 1A, showing one embodiment of a pixel of a liquid crystal display device according to the present invention.

Fig. 2A is a diagrammatic plan view and Fig. 2B is a detail view of the section B in Fig. 2A, showing one embodiment of the overall liquid crystal display device according to the present invention.

Fig. 3A is a diagrammatic view and Fig. 3B is a section view taken along line b-b in Fig. 3A, showing one example of repairing a pixel of the liquid crystal display device shown in Fig. 1A.

Fig. 4A is a diagrammatic plan view and Fig. 4B is a section view taken along line b-b in Fig. 4A, showing another embodiment of a pixel of the liquid crystal display device according to the present invention.

Fig. 5A is a diagrammatic plan view and Fig. 5B is a sectional view

taken along line b-b in Fig. 5B, showing one exampl of repairing a pixel of the liquid crystal display device shown in Fig. 4A.

Fig. 6A is a diagrammatic plan view and Fig. 6B is a section taken along line b-b in Fig. 6A, showing another embodiment of a pixel of the liquid crystal display device according to the present invention.

Fig. 7A is a diagrammatic plan view and Fig. 7B is a sectional view taken along line b-b in Fig. 7A, showing one example of repairing a pixel of the liquid crystal display device shown in Fig. 6A.

Fig. 8A is a diagrammatic plan view and Fig. 8B is a sectional view taken along line b-b in Fig. 8A, showing another embodiment of a pixel of the liquid crystal display device according to the present invention.

Fig. 9 is a diagrammatic plan view showing one example of repairing a pixel of the liquid crystal display device shown in Fig. 8A.

Fig. 10A is a diagrammatic plan view and Fig. 10B is a sectional view taken along line b-b in Fig. 10A, showing another embodiment of a pixel of the liquid crystal display device according to the present invention.

Fig. 11A is a diagrammatic plan view and Fig. 11B is a sectional view taken along line b-b in Fig. 11A, showing another embodiment of a pixel of the liquid crystal display device according to the present invention.

Fig. 12 is a diagrammatic plan view showing one example of repairing a pixel of the liquid crystal display device shown in Fig. 11A.

Fig. 13A is a diagrammatic plan view and Fig. 13B is a sectional view taken along line b-b in Fig. 13A, showing another embodiment of the pixel of a liquid crystal display device according to the present invention.

Fig. 14A is a diagrammatic plan view and Fig. 14B is a sectional view taken along line b-b in Fig. 14A, showing another embodiment of a pixel of the

liquid crystal display device according to the present invention.

Fig. 15 is a diagram showing the connection relationship between a capacitance signal line and a light transmitting conductive layer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the liquid crystal display device according to the present invention will be explained hereinafter in conjunction with the attached drawings.

Embodiment 1.

<<Liquid crystal display panel>>

Fig. 2A is a plan view showing the overall constitution of a liquid crystal display panel incorporated into a liquid crystal display device according to the present invention, and Fig. 2B is an equivalent circuit diagram of a pixel region indicated by a circle B in Fig. 2A.

In Fig. 2A, there are a pair of transparent substrates SUB1, SUB2 which are arranged so as to face each other while sandwiching liquid crystal therebetween, wherein the liquid crystal is sealed by a sealing material SL, which is also serves to fix the transparent substrate SUB2 to the transparent substrate SUB1.

On a liquid-crystal-side surface of the transparent substrate SUB1 which is surrounded by the sealing material SL, there are gate signal lines GL, which extend in the x direction and are arranged in parallel in the y direction, and drain signal lines DL, which extend in the y direction and are arranged in parallel in the x direction.

Regions which are surrounded by the respective gate signal lines GL and the respective drain signal lines DL constitute pixel regions; and, a

plurality of these pixel regions, which are disposed in a matrix array, form a liquid crystal display part AR.

Further, on the respective pixel regions which are arranged in parallel in the x direction, a common counter voltage signal line CL is formed such that the counter voltage signal line CL runs through the respective pixel regions. The counter voltage signal line CL constitutes a signal line for supplying a voltage which becomes a reference with respect to the video signal supplied to the counter electrodes CT of respective pixel regions, as will be explained later.

In each pixel region, as seen in Fig. 2B, a thin film transistor TFT, which is operated by a scanning signal from the one-side gate signal line GL, and a pixel electrode PX to which a video signal is supplied from the one-side drain signal line DL by way of the thin film transistor TFT, are formed. An electric field is generated between the pixel electrode PX and the counter electrode CT, which is connected to the counter voltage signal line CL, and the optical transmissivity of the liquid crystal in the vicinity of the pixel is controlled in response to this electric field.

One of the ends of the each of gate signal lines GL extends over the sealing material SL, and the extended ends constitute terminals GLT, to which output terminals of a scanning signal driving circuit V are connected. Further, to the input terminals of the scanning signal driving circuit V, signals from a printed circuit board (not shown in the drawing), which is arranged outside the liquid crystal display panel, are inputted. The scanning signal driving circuit V includes a plurality of semiconductor devices, wherein a plurality of gate signal lines GL, which are adjacent to each other, are formed into a group, and one semiconductor device is allocated to each group of gate signal lines

GL.

In the same manner, one of the ends of each of the drain signal lines DL extends over the sealing material SL and the extended ends constitute terminals DLT, to which output terminals of a video signal driving circuit He are connected. Further, to input terminals of the video signal driving circuit He, signals from a printed circuit board (not shown in the drawing), which is arranged outside the liquid crystal display panel, are inputted.

The video signal driving circuit He also includes a plurality of semiconductor devices, wherein a plurality of drain signal lines DL, which are adjacent each other, are formed into a group and one semiconductor device is allocated to each group of drain signal lines DL.

Further, the counter voltage signal lines CL have the right-side end portions thereof, as seen in the drawing, for example, connected in common, the connection line extends over the sealing material SL and the extended end constitutes a terminal CLT. A voltage which constitutes a reference with respect to the video signal is supplied from this terminal CLT.

The respective gate signal lines GL are sequentially selected one after another in response to the scanning signals from the scanning signal driving circuit V.

Further, to the respective drain signal lines DL, the video signals are supplied from the video signal driving circuit He in conformity with the timing for selecting the gate signal lines GL.

In the above-mentioned embodiment, the scanning signal driving circuit V and the video signal driving circuit He are formed of semiconductor devices which are mounted on the transparent substrate SUB1. However, these circuits may be constituted of a so-called tape carrier type

semiconductor device which establishes a connection between the transparent substrate SUB1 and the printed circuit board (not shown in the drawing) by spanning. Further, when a semiconductor layer of the thin film transistor TFT is made of polycrystalline silicon (p-Si), a semiconductor element made of the polycrystalline silicon may be formed on the surface of the transparent substrate SUB1 together with the wiring layers, for example.

<<Constitution of pixel>>

Fig. 1A is a plan view showing one embodiment of the constitution of a pixel formed in the above-mentioned pixel region. Further, Fig. 1B is a cross-sectional view taken along a line b-b in Fig. 1A.

On a liquid-crystal-side surface of the transparent substrate SUB1, first of all, the gate signal lines GL, which extend in the x direction and are arranged in parallel in the y direction, and the drain signal lines, which extend is the y direction and are arranged in parallel in the x direction, are formed.

These gate signal lines GL form rectangular regions together with the drain signal lines DL, as will be explained later, and these regions constitute the pixel regions.

Further, in the region defined between the respective gate signal lines GL, the counter voltage signal lines CL, which are arranged in parallel to the gate signal lines GL, are formed.

These counter voltage signal lines CL are integrally formed with the counter electrodes CT, wherein the counter electrodes CT are constituted of a group consisting of a plurality of (three in the drawing) electrodes which extend in the y direction and are arranged in parallel in the x direction within the pixel region. The separation distance between respective electrodes is set to be substantially equal.

Here, among the above-mentioned group of electrodes, a pair of counter electrodes CT which are positioned at both sides of the pixel, for example, that is, the counter electrodes CT which are arranged close to the drain signal lines DL, have a width which is slightly larger than the width of the counter electrode CT disposed at the center of the pixel. This is because an electric field from the drain signal line DL can be easily terminated to the counter electrode CT which is disposed close to the drain signal line DL, and in this way it is possible to prevent the electric field from terminating to the pixel electrode PX, to be described later, by passing over the counter electrode CT. That is, when the electric field is terminated to the pixel electrode PX, this gives rise to the generation of noise.

Further, of the respective counter electrodes CT which are arranged close to the drain signal lines DL, one counter electrode CT (the counter electrode which is positioned at the left side in the drawing, for example) is provided with a plurality of extension portions CTE, which extension portions CTE extend to regions where the drain signal line DL is formed.

That is, in the respective regions which are formed when the pixel region is divided into halves by the counter voltage signal line CL, the above-mentioned extension portions CTE are formed at a portion of the counter electrode CT which is arranged close to the counter voltage signal line CL and at a distal end portion of the counter electrode CT which is arranged remote from the counter voltage signal line CL.

The indication that the extension portions CTE reach the region where the drain signal line DL is formed implies that, when the drain signal line DL is formed later, portions of the drain signal line DL are overlapped with respect to the extension portions CTL. An advantageous effect brought about by these

extension portions CTL will be explained later.

On the surface of the transparent substrate SUB1 on which the gate signal lines GL and the counter voltage signal lines CL are formed in this manner, an insulation film GI, which is formed of a silicon nitride film (for example, SiN), for example, is formed such that the insulation film GI also covers the gate signal lines GL, the counter voltage signal lines CL and the counter electrodes CT, as seen in Fig. 1B. This insulation film GI functions as an interlayer insulation film with respect to the gate signal lines GL and the counter voltage signal lines CL in the region where the drain signal lines DL are formed. The insulation film GI functions as a gate insulation film in a region where the thin film transistor TFT is formed. Further, the insulation film GI functions as a dielectric film in a region where a capacitance element Cstg is formed.

Then, on a surface of the insulation film GI, a semiconductor layer AS which is made of amorphous Si, for example, is formed such, that the semiconductor layer AS is overlapped with respect to portions of the gate signal lines GL. This semiconductor layer AS is a semiconductor layer of the thin film transistor TFT, wherein by forming a drain electrode SD1 and a source electrode SD2 on an upper surface of the semiconductor layer AS, it is possible to constitute an MIS (Metal Insulator Semiconductor) type transistor having an inverse staggered structure, which uses a portion of the gate signal line GL as a gate electrode.

Here, the drain electrode SD1 and the source electrode SD2 are formed simultaneously at the time of forming the drain signal lines DL. That is, the drain signal lines DL, which extend in the y direction and are arranged in parallel in the x direction, are formed. Portions of the drain signal lines DL

are extended to upper surfaces of the semiconductor layers AS to form drain electrodes SD1. Still further, the source electrodes SD2 are formed so as to be spaced from the drain electrodes SD1 by an amount corresponding to the channel length of the thin film transistor TFT.

Further, at the time of forming the drain signal lines DL, the pixel electrodes PX are simultaneously and integrally formed with the source electrodes SD2. The pixel electrode PX is constituted of a plurality of (two in the drawing) electrodes which extend in the y direction and are arranged in parallel in the x direction. The respective electrodes PX are arranged to be positioned between respective counter electrodes CT, as seen plan view. That is, the respective electrodes are arranged in the order of the counter electrode CT, the pixel electrode PX, the counter electrode CT, the pixel electrode PX, ..., the counter electrode CT at equal intervals from one-side drain signal line DL to the other-side drain signal line DL within the pixel.

Further, the pixel electrodes PX, which are constituted of a group of electrodes in this manner, have bridging portions thereof, which overlap with the counter voltage signal lines CL, so that the pixel electrodes PX are electrically connected to each other.

The portions of the counter voltage signal lines CL which are overlapped by the respective pixel electrodes PX have a relatively large area, and capacitance elements Cstg, which use the insulation film, GI as a dielectric film are formed in these portions. These capacitance elements Cstg are designed to perform the function of storing the video signals supplied to the pixel electrodes PX, for example, for a relatively long period of time.

Here, on an interface between the semiconductor layer AS and the drain electrode SD1 and the source electrode SD2, a thin layer, which is

doped with impurities of high concentration, is formed, and this layer functions as a contact layer. With respect to this contact layer, an impurity layer of high concentration is already formed on a surface thereof at the time of forming the semiconductor layer AS, for example, and it can be formed by using patterns of the drain electrode SD1 and the source electrode SD2, which are formed on an upper surface of the contact layer, as masks and by etching the impurity layer exposed from the patterns.

In this manner, on the surface of the transparent substrate SUB1 on which the thin film transistors TFT, the drain signal lines DL, the drain electrodes SD1, the source electrodes SD2 and the pixel electrodes PX are formed, a protective film PAS, which is formed of a silicon nitride film (for example, SiN), for example, is formed. This protective film PAS serves to prevent direct contact of the liquid crystal with the thin film transistor TFT and to prevent deterioration of the characteristics of the thin film transistors TFT. It is needless to say that, as another material of this protective film, an organic material, such as a resin, for example, can be used besides the inorganic material.

Then, on an upper surface of the transparent substrate SUB1 on which the protective film PAS is formed, an orientation film (not shown in the drawing) is formed such that the orientation film covers the protective film PAS. The orientation film is a film which is brought into direct contact with the liquid crystal and determines the initial orientation direction of molecules of the liquid crystal by rubbing formed on a surface of the orientation film.

In the liquid crystal display device having such a constitution, as shown in Fig. 3A, which corresponds to Fig. 1A, when disconnection occurs at substantially the center of the portion of the drain signal line DL which is

positioned in the upper sid of the pixel region, which is halved by the counter voltage signal line CL, the drain signal line DL is repaired as follows.

First of all, the counter electrode CT, which is arranged close to the drain signal line DL on which the disconnection occurs, is cut at a portion thereof close to the counter voltage signal line CL so as to terminate the electrical connection between this portion of the counter electrode CT and the counter voltage signal line CL. To be more specific, the portion of the counter electrode CT, which is disposed between the extension portion CTE, which is formed on the counter electrode CT, and is close to the counter voltage signal line CL and the counter voltage signal line CL, is divided. Cutting or dividing of the counter electrode CT can be easily performed using the scanning of laser beams, for example.

Next, laser beams are radiated to a portion of the drain signal line DL which overlaps to the extension portion CTE formed on the counter electrode CT close to the counter voltage signal line CL so as to establish an electrical connection between the drain signal line DL and the extension portion CTE. That is, due to the radiation of the laser beams, a hole is formed in the drain signal line DL and the insulation film GI arranged below the drain signal line DL; and, at the same time, due to melting of the material of the drain signal line DL, the material is adhered to the extension portion CTE so that an electrical connection is established between the drain signal line DL and the extension portion CTE.

Further, laser beams are radiated also to a portion of the drain signal line DL which overlaps the other extension portion CTE formed on the distal end portion (portion remote from the counter voltage signal line CL) of the counter electrode CT so as to establish an electrical connection between the

drain signal line DL and the extension portion CTE.

Here, it is not always necessary to perform the above-mentioned three operations in the above-mentioned order; rather, the order may be arbitrarily determined.

After performing such an operation, the counter electrode CT which is arranged close to the drain signal line DL, which was disconnected, loses its function and functions as a bypass of the drain signal line DL. Accordingly, the drain signal line DL is repaired.

In this case, a region A which is disposed between the existing counter electrode CT, which function as the bypass, and the pixel electrode PX, which is arranged close to the counter electrode CT, loses its pixel display function. However, this region is considered to be an extremely small region compared to the remaining regions ranging from the region B to the region H, where the normal display is performed, and, hence, it is possible to maintain the pixel region to a state which hardly affects the display.

Embodiment 2.

Fig. 4A is a plan view showing another embodiment of a pixel of the liquid crystal display device according to the present invention. Fig. 4B is a cross-sectional view taken along a line b-b in Fig. 4A.

The constitution which makes this embodiment different from the embodiment shown in Fig. 1A lies in the fact that, first of all, the counter electrode CT, which runs in the y direction at the center of the pixel region (the counter electrode CT excluding at least the counter electrodes CT which are arranged close to the drain signal lines DL) is formed on an upper surface of the protective film PAS. Further, the counter electrode CT which is formed on the upper surface of the protective film PAS is integrally formed with a grid-like

conductive layer, which is formed on the protective film PAS such that the conductive layer covers the gate signal lines GL and the drain signal lines DL.

To enhance the numerical aperture of the pixel, for example, the conductive layer is made of a light transmitting material such as ITO (Indium Tin Oxide), ITZO (Indium Tin Zinc Oxide), IZO (Indium Zinc Oxide), SnO_2 (zinc oxide), In_2O_3 (indium oxide) or the like. Accordingly, in this specification, the conductive layer will be referred to as a "light transmitting conductive layer TCL" hereinafter.

The light transmitting conductive layer TCL, which is formed so as to cover the gate signal lines GL and the drain signal lines DL, is configured so as to make the electric field that is generated in response to respective signals supplied to the gate signal lines GL and the drain signal lines DL terminate thereto. This is because, when the electric field is terminated to the pixel electrode PX, this gives rise to the generation of noise, thus degrading the quality of the display. Accordingly, the light transmitting conductive layer TCL, which is formed in a grid pattern, has a center axis thereof substantially aligned with the center axes of the gate signal line GL and the drain signal line DL, and, at the same time, the light transmitting conductive layer TCL has a large width.

Further, such a light transmitting conductive layer TCL is configured to function as a counter voltage signal line which supplies counter voltage signals to the counter electrodes CT that are integrally formed with the light transmitting conductive layer TCL. Accordingly, it is also possible to achieve an advantageous effect in that the total electric resistance value of the light transmitting conductive layer TCL together with the counter voltage signal line CL can be reduced.

Further, due to such a feature, the protective film PAS is constituted of a sequential laminated body particularly consisting of a protective film PAS1 that is formed of an inorganic material layer, such as silicon nitride film (for example, SiN), for example, and a protective film PAS2 that is formed of an organic material layer made of resin, for example. This constitution is provided for reducing the dielectric constant of the protective film PAS as a whole so as to reduce the parasitic capacitance between the light transmitting conductive layer TCL and the gate signal line GL or the drain signal line DL.

Also, in the above-mentioned constitution, the counter electrode CT, which is formed close to the drain signal line DL is, in the same manner as the constitution described with reference to the embodiment 1, that is, as shown in Fig. 5A corresponding to Fig. 4A, provided with extension portions CTE which overlaps the drain signal line DL at a portion of the counter electrode CT close to the counter voltage signal line CL and at the distal end portion of the counter electrode CT.

Also in this case, it is possible to repair the drain signal line DL in the same manner as shown in Fig. 3A and Fig. 3B.

Here, in the above-mentioned embodiment, the signal line which runs in the x direction at the center of the pixel region is formed as the counter voltage signal line CL. However, it is needless to say that this signal line may be formed as the capacitance signal line CPL.

A connection portion of the pixel electrode PX, which is constituted of a group of electrodes consisting of two electrodes, for example, is positioned above the capacitance signal line CPL, and a capacitance element Cstg which uses an insulation film GI as a dielectric is formed between the capacitance signal line CPL and the connection portion.

In this case, an electrode (corresponding to the counter electrode CT in Fig. 4A) which is arranged close to the drain signal line DL and is connected to the capacitance signal line (corresponding to counter voltage signal line CL in Fig. 4A) is configured to function as a shield electrode, which terminates the electric field from the drain signal line DL and also is configured to function as a bypass line at the time of repair.

Embodiment 3.

Fig. 6A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig 6B is a cross-sectional view taken along a line b-b in Fig. 6A. The constitution which makes this embodiment different from the constitution shown in Fig. 4A lies in the fact that notched portions CUT are formed in portions of the light transmitting conductive layer TCL, which is integrally formed with the counter electrode CT formed on the upper surface of the protective film PAS.

That is, the notched portions CUT are formed in the light transmitting conductive layer TCL at portions thereof arranged above the drain signal line DL and overlap the extension portions CTE of the counter electrode CT close to the drain signal line DL, such that the extension portions CTE are exposed from the light transmitting conductive layer TCL.

Due to such a constitution, as shown in Fig. 7A, which corresponds to Fig. 6A, at the time of repairing the disconnection of the drain signal line DL, the light transmitting conductive layer TCL is not formed at the portions to which laser beams are radiated.

Accordingly, it is possible to obtain an advantageous effect in that the repairing of the disconnection can be surely performed even after the light

transmitting conductive layer TCL is formed. That is, it is possible to structurally eliminate the possibility that the extension portions CTE of the extension portion CTE or the drain signal line DL and the light transmitting conductive layer TCL are short-circuited at the time of repairing the disconnection using laser beams. This advantageous effect is obtained when the extension portions CTE of the counter electrode CT are notched at crossing portions of the extension portion CTE and the drain signal line DL. Accordingly, in the constitution where the line or electrode has an overlapped position below the drain signal line DL by way of an insulation film and a conductive layer is formed above the drain signal line DL by way of an insulation film corresponding to the overlapped portion, it is possible to repair the disconnection by providing a notch or a rectangular removal pattern in the conductive layer. Further, as the notch or the rectangular removal pattern, when the conductive layer remains, it is possible to hold the electrical connection around the overlapped position, and, hence, it is possible to maintain a shielding of a leaked electric field from the drain signal line DL due to the light transmitting conductive layer TCL in the major region of the drain signal line DL, other than the overlapped position.

In view of the above-mentioned concept of this embodiment, it is needless to say that the notched portions CUT are formed as hole portions. This is because it is sufficient to have a pattern in which the light transmitting conductive layer TCL is not formed at portions to which laser beams are radiated.

Here, it is needless to say that, also in this embodiment, the counter voltage signal line CL is formed as the capacitance signal line.

Embodiment 4.

Fig. 8A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 8B is a cross-sectional view taken along a line b-b in Fig. 8A.

As opposed to the embodiment shown in Fig. 4A, repairing of a disconnection of the drain signal line DL is not taken into consideration in this embodiment. That is, this embodiment provides a constitution which facilitates repairing of short-circuiting which is generated between the drain signal line DL and the gate signal line GL via a through hole or the like formed in the insulation film GI, that is formed as a layer below the drain signal line DL at the time of forming the drain signal line DL.

That is, a slit SLT which is arranged parallel to the running direction of the gate signal line GL is formed in a portion of the gate signal line GL which crosses the drain signal line DL. The slit SLT is formed to have a length which allows the slit to sufficiently extend over the drain signal line DL.

Then, in the light transmitting conductive layer TCL, which is integrally formed with the counter electrode CT on an upper surface of the protective film PAS2, at a portion where the gate signal line GL crosses the drain signal line DL, a hole portion OH, which has a larger extension than the portion, is formed. In other words, this embodiment is configured such that the hole portion of the light transmitting conductive layer TCL is formed such that the hole portion sufficiently exposes the portion where the gate signal line GL crosses the drain signal line DL, so that the repairing of a short-circuit using laser beams is facilitated by this portion.

That is, as shown in Fig. 9, corresponding to Fig. 8A, when a short-circuiting (indicated by "x" in the drawing) occurs between the drain signal line DL and the gate signal line GL via the insulation film GI that is

formed below the drain signal line DL at the time of forming the drain signal line DL, the laser beams are scanned from both ends of the slit SLT to the side portions of the respective gate signal lines GL, so that a portion of the gate signal line GL which is short-circuited with the drain signal line DL is electrically isolated.

In this case, since the light transmitting conductive layer TCL is not formed at the portion which the laser beams scan, it is possible to easily repair the short-circuiting even after the formation of the light transmitting conductive layer TCL.

Embodiment 5.

Fig. 10A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 10B is a cross-sectional view taken along a line b-b in Fig. 10A.

The constitution which makes this embodiment different from the embodiment shown in Fig. 8A lies in the fact that, with respect to portions which are repaired by the scanning of laser beams, the hole portions POH are formed not only in the light transmitting conductive layer TCL, but also in the protective film PAS2 that is arranged below the light transmitting conductive layer TCL.

In this case, at the time of forming the light transmitting conductive layer TCL, in order to prevent a material of the light transmitting conductive layer TCL from being formed on the side wall surfaces of the protective film PAS2, the hole portions OH of the light transmitting conductive layer TCL are formed to be larger than the hole portions POH that are formed in the protective film PAS2.

This provision is adopted so as to sufficiently achieve the parasitic

capacitance reduction effect between the light transmitting conductive layer TCL and the drain signal line DL due to the protective film PAS2 formed of an organic material.

Further, when the light transmitting conductive layer TCL is arranged at the side face, the probability of occurrence of short-circuiting at the time of repairing using laser beams is increased. This provision is made to structurally eliminate such a possibility.

Compared to the protective film PAS1 which is formed of an inorganic film, since the protective film PAS2 is formed of an organic film, the protective film PAS2 is liable to be easily dissolved, evaporated or diffused due to heat generated by the laser beams. When the evaporation or the diffusion of the protective film PAS2 occurs at the time of performing repairing using laser beams, although the lines may be repaired, they contaminate the liquid crystal, thus generating new minute defective regions, and, hence, a complete repair cannot be obtained. Accordingly, to obtain a structure in which repair of the lines can be achieved more reliably, regions for removing the protective film PAS2 are formed as the hole portions POH in the opening portions of the hole portions OH. Due to such a constitution, at the time of repairing the lines using laser beams, it is possible to obviate the occurrence of secondary defects attributed to the above-mentioned protective film PAS2.

Embodiment 6.

Fig. 11A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 11B is a cross-sectional view taken along a line b-b in Fig. 11A.

The constitution which makes this embodiment different from the embodiment shown in Fig. 4A lies, first of all, in the fact that the counter

voltage signal lines CL and the counter electrodes CT, which are integrally formed with the counter voltage signal lines CL, are not formed. That is, the counter electrodes CT are formed on an upper surface of the protective film PAS2 and are integrally formed with a light transmitting conductive layer TCL, which is formed such that the light transmitting conductive layer TCL covers the gate signal lines GL and the drain signal lines DL.

In this case, the light transmitting conductive layer TCL which covers the drain signal lines DL has a shielding function with respect to the drain signal lines DL and, at the same time, functions as the counter electrode CT. That is, portions of the light transmitting conductive layer TCL which are projected into the inside of the pixel region from the drain signal line DL function as the counter electrodes CT, and an electric field is generated between such counter electrode CT and the pixel electrode PX arranged close to the counter electrode CT.

Then, the signal lines which run in the x direction at approximately the center portion of the pixel region are constituted as capacitance signal lines CPL, and these capacitance signal lines CPL are formed simultaneously with the formation of the gate signal lines GL.

Further, the capacitance signal line CPL is, as shown in Fig. 15, electrically connected to the above-mentioned light transmitting conductive layer TCL over the protective film PAS2 via the contact portions CNT in regions outside the liquid crystal display portion AR. That is, the capacitance signal line CPL is configured so as not to be connected with the contact portions CNT within the pixel region. Here, the contact portion CNT is formed of a hole which sequentially penetrates or passes through the protective film PAS2, the protective film PAS1 and the insulation film GI.

Above the capacitance signal line CPL, there is a connection or bridging portion between the pixel electrodes PX consisting of a group of two electrodes, and a capacitance element Cstg is formed which uses an insulation film GI as a dielectric between the capacitance signal line CPL and this connection portion.

In such a constitution, at a portion where the capacitance signal line CPL and the drain signal line DL cross each other, a slit SLT is formed such that the slit SLT extends over the drain signal line DL. In this case, as shown in Fig. 12, which corresponds to Fig. 11A, when short-circuiting occurs between the drain signal line DL and a portion of the capacitance signal line CPL (indicated by a mark × in the drawing) at the time of forming the drain signal line DL, laser beams are scanned from both ends of the slit SLT to one side of the capacitance signal line CPL so as to form the notch. Accordingly, it is possible to electrically isolate the portion of the capacitance signal line CPL which is short-circuited with the drain signal line DL, thus achieving the required repair.

Embodiment 7.

Fig. 13A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Fig. 13B is a cross-sectional view taken along a line b-b in Fig. 13A.

The constitution which makes this embodiment different from the embodiment shown in Fig. 11A lies in the fact that, at crossing portions of the capacitance signal line CPL and the drain signal lines DL, the hole portions OH which surround the crossing portions and peripheries thereof are formed in the light transmitting conductive layer TCL, which is formed on the upper surface of the protective film PAS2. In other words, at the crossing portions

of the capacitance signal line CPL and the drain signal lines DL, the light transmitting conductive layer TCL is configured such that the light transmitting conductive layer TCL is not formed on the crossing portions and the peripheries thereof.

Due to such a constitution, after forming the counter electrodes CT and the light transmitting conductive layer TCL, which is formed integrally with the counter electrodes CT, it is possible to easily perform repair as described with reference to the embodiment 6.

Embodiment 8.

Fig. 14A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Fig. 14B is a cross-sectional view taken along a line b-b in Fig. 14A.

The constitution which makes this embodiment different from the embodiment shown in Fig. 13A lies in the fact that, at the crossing portions of the capacitance signal line CPL and the drain signal lines DL, the hole portions POH are formed not only in the light transmitting conductive layer TCL, but also in the protective film PAS2. In other words, at the crossing portions of the capacitance signal line CPL and the drain signal lines DL, the light transmitting conductive layer TCL is configured such that the protective film PAS2 and the light transmitting conductive layer TCL are not formed on the crossing portions and the peripheries thereof.

Due to such a constitution, the protective film PAS2, which is formed of an organic material layer, is not also formed at portions to which the laser beams are scanned for repairing, and, hence, there arises no drawback attributed to melting of the protective film PAS2. Thus, it is possible to achieve a reliable repairing.

The above-mentioned embodiments may be used in a single form or in combination. This is because the advantageous effects of the respective embodiments can be obtained in a single form or in a combined manner.

As can be clearly understood from the above-mentioned explanation, with the liquid crystal display device according to the present invention, it is possible to easily perform repair and to realize an enhancement of the yield rate.

add line numbers

LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND OF THE INVENTION

~~1. FIELD OF THE INVENTION~~

The present invention relates to a liquid crystal display device.

~~2. DESCRIPTION OF THE RELATED ART~~

~~As the constitution~~ Various types of a liquid crystal display device, ~~various types of constitutions have been~~ are known. To ~~explain~~ take a lateral field type liquid crystal display device as an example, in pixel regions formed on a liquid-crystal-side surface of one substrate of ~~respective~~ a pair of substrates, which are arranged to face each other in an opposed manner while sandwiching liquid crystal material therebetween, pixel electrodes and counter electrodes are formed, and the optical transmissivity of the liquid crystal is controlled in response to an electric field that is generated between respective electrodes.

Further, with respect to an active matrix type liquid crystal display device to which the above technique is applied, on a liquid-crystal-side surface of one substrate, respective regions, which are surrounded by gate signal lines which extend in the x direction and are arranged in parallel in the y direction and drain signal lines which extend in the y direction and are arranged in parallel in the x direction, are defined as the above-mentioned pixel regions, and a switching element is provided

~~to~~ in each pixel region.

~~Then, a~~ A video signal from the drain signal line is supplied to the pixel electrode by way of the switching element and, at the same time, the switching element is turned on in response to a scanning signal received from the gate signal line.

Further, a signal which becomes ~~the~~ a reference with respect to the video signal is supplied to ~~the~~ counter electrodes in each pixel by way of counter voltage signal lines, for example.

This liquid crystal display device ~~is known as a liquid crystal display device which~~ can produce ~~obtain~~ a display of a good quality having a favorable contrast, and it also has so-called wide viewing angle characteristics.

SUMMARY OF THE INVENTION

When the definition of the liquid crystal display device is increased and the distance between lines becomes short, the probability of occurrence of drawbacks such as the disconnection of signal lines (for example, drain signal lines or the like) or short-circuiting with other signal lines ~~are~~ is increased in the a manufacturing stage. Further, in the lateral field type liquid crystal display device, ~~with respect to the pixel in each pixel region,~~ due to the fact ~~a constitution~~ that strip-like counter electrodes and pixel electrodes are alternately arranged and the like in each pixel region, the distance between electrodes or the distance between the electrode and the line is relatively finely formed; and, along with such

relatively fine molding, the probability of occurrence of drawbacks, such as the disconnection of signal lines (for example, drain signal lines or the like) or short-circuiting with other signal lines is relatively increased in ~~a~~ the manufacturing stage, thus giving rise to ~~a~~ the tendency that ~~a~~ the so-called yield rate is lowered.

Since the disconnection or the like of one signal line will bring all of a group of pixels related to the signal line into a display failure condition, it is necessary to perform repairing, such that the disconnection or the like of one signal line causes ~~the~~ a display failure of only one pixel, for example.

The present invention has been made in view of such a circumstance; and, it is an object ~~advantage~~ of the present invention to facilitate the repair ~~repairing~~ of a liquid crystal display device.

~~To illustrate the~~ A summary of typical aspects of the ~~inventions among~~ invention ~~inventions~~ disclosed in the present application, ~~they are~~ is as follows.

(1) A liquid crystal display device is formed of ~~with~~ a pair of substrates with a liquid crystal layer disposed therebetween, at least a first conductive layer formed on one of said pair of substrates, at least a first insulating layer formed on the first conductive layer, a plurality of drain signal lines formed on the first insulating layer ~~with~~ in overlapping relation to the first conductive layer, at least a second insulating layer formed on the drain signal line, at least a second conductive layer formed

on the second insulating layer and elongated substantially along the drain signal line ~~with~~ in overlapping relation to the drain signal line, wherein the second conductive layer is ~~stand-off~~ spaced from the overlapping region of the first conductive layer and the drain signal line.

(?)

(2)A liquid crystal display device ~~with~~ is formed of a pair of substrates with a liquid crystal layer disposed therebetween, a plurality of gate signal lines and at least a first conductive layer formed on one of said pair of substrates, at least a first insulating layer formed on the gate signal line, a plurality of drain signal lines formed on the first insulating layer and crossing ~~to~~ the gate signal line, at least a second insulating layer formed on the drain signal line, wherein the first conductive layer is elongated substantially along the drain signal line and has a portion ~~having~~ overlapping ~~portion to~~ the drain signal line, at least a second conductive layer formed on the second insulating layer and elongated substantially along the drain signal line ~~with~~ in overlapping relation to the drain signal line and the first conductive layer, ~~a~~ wherein the width of the second conductive layer at the overlapping region of the drain signal line and the first conductive layer is smaller than ~~not~~ the non-overlapping region of the drain signal line and the first conductive layer.

(3) A liquid crystal display device ~~with~~ is formed of a pair of substrates with a liquid crystal layer disposed therebetween, at least a first conductive layer formed on one of said pair of substrates,

at least a first insulating layer formed on the first conductive layer, a plurality of drain signal lines formed on the first insulating layer ~~with~~ in overlapping relation to the first conductive layer, at least a second insulating layer formed on the drain signal line, at least a second conductive layer formed on the second insulating layer and elongated substantially along the drain signal line ~~with~~ in overlapping relation to the drain signal line, wherein the second conductive layer ~~have~~ has a hole at the overlapping region of the first conductive layer and the drain signal line.

~~Here, the~~ The present invention is not limited to the above-mentioned constitutions and various modifications can be made without departing from the technical concept of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a diagrammatic plan ~~constitutional~~ view and Fig 1B is a section taken along line 6-6 in Fig 1A, showing one embodiment of a pixel of a liquid crystal display device according to the present invention.

Fig. 2A is a diagrammatic plan view and Fig 2B is a detail view of the section B in Fig 2A, showing one embodiment of the overall ~~whole of the~~ liquid crystal display device according to the present invention.

Fig. 3A is a diagrammatic plan view ~~for explaining~~ and Fig 3B is a section view taken along line 6-6 in Fig 3A, showing one ~~embodiment~~ example of repairing ~~of~~ a pixel of the liquid crystal display device shown in Fig. 1A.

Fig. 4A is a diagrammatic plan ~~constitutional~~ view and Fig 4B is a section view taken along line 6-6 in Fig 4A, showing another embodiment

of ~~the~~ a pixel of the liquid crystal display device according to the present invention.

Fig. 5A is a diagrammatic plan view ~~for explaining~~ and Fig 5B is a sectional view taken along line 6-6 in Fig 5B, showing one ~~embodiment~~ example of repairing ~~of~~ a pixel of the liquid crystal display device shown in Fig. 4A.

Fig. 6A is a diagrammatic plan ~~constitutional~~ view and Fig 6B is a section taken along line 6- in Fig 6A, showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention.

Fig. 7A is a diagrammatic plan view ~~for explaining~~ and Fig 7B is a sectional view taken along line 6-6 in Fig 7A, showing one example ~~embodiment~~ of repairing ~~of~~ a pixel of the liquid crystal display device shown in Fig. 6A.

Fig. 8A is a diagrammatic plan ~~constitutional~~ view and Fig 8B is a sectional view taken along line 6-6 in Fig 8A, showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention.

Fig. 9 is a diagrammatic plan view ~~for explaining~~ showing one ~~embodiment~~ example of repairing ~~of~~ a pixel of the liquid crystal display device shown in Fig. 8A.

Fig. 10A is a diagrammatic plan ~~constitutional~~ view and Fig 10B is a sectional view taken along line 6-6 in Fig 10A, showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention.

Fig. 11A is a diagrammatic plan ~~constitutional~~ view and Fig 11B is a sectional view taken along line 6-6 in Fig 11A, showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention.

Fig. 12 is a diagrammatic plan view ~~for explaining~~ showing one ~~embodiment~~ example of repairing ~~of~~ a pixel of the liquid crystal display device shown in Fig.

11A

Fig. 13A is a ~~constitutional~~ diagrammatic plan view showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention and Fig 13B is a sectional view taken along line 6-6 in Fig 13A.

Fig. 14A is a ~~constitutional~~ diagrammatic plan view showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention and Fig 14B is a sectional view taken along line 6-6 in Fig 14A.

Fig. 15 is ~~an explanatory view~~ a diagram showing the connection relationship between a capacitance signal line and a light transmitting conductive layer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the liquid crystal display device according to the present invention ~~are~~ will be explained hereinafter in conjunction with the attached drawings.

Embodiment 1.

<<Liquid crystal display panel>>

~~Fig. 2 is a plan view showing one embodiment of a liquid crystal display panel incorporated into a liquid crystal display device according to the present invention.~~ Fig. 2(A) is a plan view showing the ~~whole~~ overall constitution of a liquid crystal display panel incorporated into a ~~the~~ liquid crystal display device according to the present invention and Fig. 2(B) is ~~a view for explaining one example of~~ diagram of an equivalent circuit ~~by enlarging~~ a pixel region indicated ~~surrounded~~ by a circle B in Fig. 2(A).

In Fig. 2A there are ~~provided~~ a pair of transparent

substrates SUB1, SUB2 which are arranged so as to face each other while sandwiching liquid crystal therebetween, wherein the liquid crystal is sealed by a sealing material SL, which is also ~~served~~ serves to fix the ~~for fixing another~~ transparent substrate SUB2 to ~~one~~ the transparent substrate SUB1.

On a liquid-crystal-side surface of the ~~above-mentioned one~~ transparent substrate SUB1 which is surrounded by the sealing material SL, there are gate signal lines GL, which extend in the x direction and are arranged in parallel in the y direction, and ~~the~~ drain signal lines DL, which extend in the y direction and are arranged in parallel in the x direction ~~are formed~~.

Regions which are surrounded by the respective gate signal lines GL and the respective drain signal lines DL constitute pixel regions; and, ~~at the same time,~~ a plurality ~~mass~~ of ~~respective~~ these pixel regions, which are disposed in a matrix array, form ~~shape constitutes~~ a liquid crystal display part AR.

Further, on the respective pixel regions which are arranged in parallel in the x direction, a common counter voltage signal line CL is formed such that the counter voltage signal line CL runs ~~in~~ through the respective pixel regions. The counter voltage signal line CL constitutes a signal line for supplying a voltage which becomes ~~the~~ a reference with respect to the video signal supplied to the counter electrodes CT of respective pixel regions, as ~~which~~ will be explained later.

In each pixel region, as seen in Fig. 2B, a thin film transistor TFT, which

is operated by a scanning signal from the one-side gate signal line GL, and a pixel electrode PX to which a video signal is supplied from the one-side drain signal line DL by way of the thin film transistor TFT, are formed.

~~The pixel electrode PX generates an~~ An electric field is generated between the pixel electrode PX and the counter electrode CT, which is connected to the counter voltage signal line CL, and the optical transmissivity of the liquid crystal in the vicinity of the pixel is controlled in response to this electric field.

~~Respective one~~ One of the ends of each of the gate signal lines GL extends ~~extend~~ over the sealing material SL, and the extended ends constitute terminals GLT, to which output terminals of a scanning signal driving circuit V are connected. Further, to the input terminals of the scanning signal driving circuit V, signals from a printed circuit board (not shown in the drawing), which is arranged outside the liquid crystal display panel, are inputted.

The scanning signal driving circuit V includes a plurality of semiconductor devices, wherein a plurality of gate signal lines GL, which are adjacent to each other, are formed into a group, and one semiconductor device is allocated to each group of gate signal lines GL.

In the same manner, ~~respective~~ one of the ends of each of the drain signal lines DL extends ~~extend~~ over the sealing material SL and the extended ends constitute terminals DLT, to which output terminals of a video signal driving circuit He are connected. Further, to input

terminals of the video signal driving circuit He, signals from a printed circuit board (not shown in the drawing), which is arranged outside the liquid crystal display panel, are inputted.

The video signal driving circuit He also includes a plurality of semiconductor devices, wherein a plurality of drain signal lines DL, which are adjacent each other, are formed into a group and one semiconductor device is allocated to each group of drain signal lines DL.

Further, the counter voltage signal lines CL have the right-side end portions thereof, as seen in the drawing, for example, connected in common, the connection line extends over the sealing material SL and the extended end constitutes a terminal CLT. A voltage which constitutes ~~the~~ a reference with respect to the video signal is supplied from this terminal CLT.

The respective gate signal lines GL are sequentially selected one after another in response to the scanning signals from the scanning signal driving circuit V.

Further, to the respective drain signal lines DL, the video signals are supplied from the video signal driving circuit He in conformity with the timing for selecting the gate signal lines GL.

In the above-mentioned embodiment, the scanning signal driving circuit V and the video signal driving circuit He are formed of ~~the~~ semiconductor devices which are mounted on ~~a~~ the transparent substrate SUB1. However, these circuits may be

constituted of a so-called tape carrier type semiconductor device which establishes ~~the~~ a connection between the transparent substrate SUB1 and the printed circuit board (not shown in the drawing) by spanning. Further, when a semiconductor layer of the thin film transistor TFT is made of polycrystalline silicon (p-Si), a semiconductor element made of the polycrystalline silicon may be formed on the surface of the transparent substrate SUB1 together with the wiring layers, for example.

<<Constitution of pixel>>

Fig. 1(A) is a plan view showing one embodiment of the constitution of ~~the~~ a pixel formed in the above-mentioned pixel region. Further, Fig. 1(B) is a cross-sectional view taken along a line b-b in Fig. 1(A).

On a liquid-crystal-side surface of the transparent substrate SUB1, first of all, the gate signal lines GL, which extend in the x direction and are arranged in parallel in the y direction, and the drain signal lines, which extend is the y direction and are arranged in parallel in the x direction, are formed.

These gate signal lines GL ~~surround~~ form rectangular regions together with the drain signal lines DL as ~~which~~ will be explained later, and these regions constitute the pixel regions.

Further, in the region defined between the respective gate signal lines GL, the counter voltage signal lines CL, which are arranged in parallel to the gate signal lines GL, are formed.

These counter voltage signal lines CL are integrally formed

with the counter electrodes CT, wherein the counter electrodes CT are constituted of a group consisting of a plurality of (three in the drawing) ~~of~~ electrodes which extend in the y direction and are arranged in parallel in the x direction within the pixel region. The separation distance between respective electrodes is set to be substantially equal.

Here, among the above-mentioned group of electrodes, a pair of counter electrodes CT which are positioned at both sides of the pixel, for example, that is, the counter electrodes ~~electrode~~ CT which are arranged close to the drain signal lines DL ~~described later~~, have a width which is ~~thereof made~~ slightly larger than the ~~a~~ width of the ~~other~~ counter electrode CT disposed at the center of the pixel.

This is because ~~that~~ an electric field from the drain signal line DL can be easily terminated to the counter electrode CT which is disposed close to the drain signal line DL, and in this way it is possible to prevent the electric field from terminating to the pixel electrode PX, to be described later, by passing over the counter electrode CT. That is, when the electric field is terminated to the pixel electrode PX, this gives rise to the generation of noise ~~noises~~.

Further, ~~out~~ of the respective counter electrodes CT which are arranged close to the drain signal lines DL, one counter electrode CT (the counter electrode which is positioned at the left side in the drawing, for example) is provided with a plurality of extension portions CTE, ~~wherein portions of the~~ which extension portions CTE extend to regions where the drain signal line DL

is formed.

That is, in the ~~in~~ respective regions which are formed when ~~by dividing~~ the pixel region is divided into ~~in~~ halves by the counter voltage signal line CL, the above-mentioned extension portions CTE are formed at a portion of the counter electrode CT which is arranged close to the counter voltage signal line CL and at a distal end portion of the counter electrode CT which is arranged remote from the counter voltage signal line CL.

The indication ~~constitution~~, that the extension portions CTE reach the region where the drain signal line DL is formed implies that, when the drain signal line DL is formed later, portions of the drain signal line DL are overlapped with respect to the extension portions CTL. An advantageous effect brought about by these extension portions CTL will be explained later.

On the surface of the transparent substrate SUB1 on which the gate signal lines GL and the counter voltage signal lines CL are formed in this manner, an insulation film GI, which is formed of a silicon nitride film (for example, SiN), for example, is formed such that the insulation film GI also covers the gate signal lines GL, the counter voltage signal lines CL and the counter electrodes CT, as seen in Fig. 1B.

This insulation film GI ~~performs a function of~~ functions as an interlayer insulation film with respect to the gate signal lines GL and the counter voltage signal lines CL in the region where the drain signal lines DL ~~described later~~ are formed. The

insulation film GI ~~performs a function of~~ functions as a gate insulation film in a region where the thin film transistor TFT ~~described later~~ is formed. Further, the insulation film GI functions as ~~performs a function of~~ a dielectric film in a region where a capacitance element Cstg ~~described later~~ is formed.

Then, on a surface of the insulation film GI, a semiconductor layer AS which is made of amorphous Si, for example, is formed, such that the semiconductor layer AS is overlapped with respect to portions of the gate signal lines GL.

This semiconductor layer AS is a semiconductor layer of the thin film transistor TFT, wherein by forming a drain electrode SD1 and a source electrode SD2 on an upper surface of the semiconductor layer AS, it is possible to constitute an MIS (Metal Insulator Semiconductor) type transistor having an inverse staggered structure, which uses a portion of the gate signal line GL as a gate electrode.

Here, the drain electrode SD1 and the source electrode SD2 are formed simultaneously at the time of forming the drain signal lines DL.

That is, the drain signal lines DL, which extend in the y direction and are arranged in parallel in the x direction, are formed. Portions of the drain signal lines DL are extended to upper surfaces of the semiconductor layers AS to form drain electrodes SD1. Still further, the source electrodes SD2 are formed so as to be ~~in a~~ spaced ~~apart manner~~ from the drain electrodes ~~electrode~~ SD1

by an amount corresponding to ~~a~~ the channel length of the thin film transistor TFT.

Further, at the time of forming the drain signal lines DL, the pixel electrodes PX are simultaneously and integrally formed with the source electrodes SD2. The pixel electrode PX is constituted of ~~in the same manner as the above-mentioned counter electrode CT, a group of~~ a plurality of (two in the drawing) ~~of~~ electrodes which extend in the y direction and are arranged in parallel in the x direction. ~~These~~ The respective electrodes PX are arranged to be positioned between ~~the~~ respective counter electrodes CT ~~when viewed~~, as seen ~~a~~ plan view. That is, ~~these~~ the respective electrodes are arranged in the order of the counter electrode CT, the pixel electrode PX, the counter electrode CT, the pixel electrode PX, ..., the counter electrode CT at ~~an~~ equal ~~interval~~ intervals ~~respectively~~ from one-side drain signal line DL to ~~an~~ the other-side drain signal line DL within the pixel.

Further, the pixel electrodes PX, which are constituted of a group of electrodes in this manner, have bridging portions thereof, which overlap with ~~overlapped to~~ the counter voltage signal lines CL, so that the pixel electrodes PX are electrically connected to each other.

The portions of the counter voltage signal lines CL ~~to~~ which are overlapped by the respective pixel electrodes PX ~~are electrically connected~~ have a relatively large area, and capacitance elements Cstg, which use the insulation film GI as a dielectric film, are formed in these portions.

These capacitance elements Cstg are designed to perform the ~~have a~~ function of storing the video signals supplied to the pixel electrodes PX, for example, for a relatively long period of time.

Here, on an interface between the semiconductor layer AS and the drain electrode SD1 and the source electrode SD2, a thin layer, which is doped with impurities of high concentration, is formed, and this layer functions as a contact layer.

With respect to this contact layer, an impurity layer of high concentration is already formed on a surface thereof at the time of forming the semiconductor layer AS, for example, and it can be formed by using patterns of the drain electrode SD1 and the source electrode SD2, which are formed on an upper surface of the contact layer, as masks and by etching the impurity layer exposed from the patterns.

In this manner, on the surface of the transparent substrate SUB1 on which the thin film transistors TFT, the drain signal lines DL, the drain electrodes SD1, the source electrodes SD2 and the pixel electrodes PX are formed, a protective film PAS, which is formed of a silicon nitride film (for example, SiN), for example, is formed. This protective film PAS ~~is served for~~ serves to prevent ~~obviating the~~ direct contact of the liquid crystal with ~~of~~ the thin film transistor TFT and ~~for preventing the~~ to prevent deterioration of the characteristics of the thin film transistors TFT. It is needless to say that, as ~~other~~ another material of this protective film, an organic material, such as a resin, for example, can be used besides the

inorganic material.

Then, on an upper surface of the transparent substrate SUB1 on which the protective film PAS is formed, an orientation film (not shown in the drawing) is formed such that the orientation film covers the protective film PAS. The orientation film is a film which is brought into direct contact with the liquid crystal and determines the initial orientation direction of molecules of the liquid crystal by rubbing formed on a surface of the orientation film.

In the liquid crystal display device having such a constitution, as shown in Fig. 3A, which corresponds to Fig. 1A, when ~~a~~ disconnection occurs at ~~the~~ substantially the center of the portion of the drain signal line DL which is positioned ~~at~~ on the upper ~~region~~ side of the pixel region, which is halved by the counter voltage signal line CL, the drain signal line DL is repaired as follows.

First of all, the counter electrode CT, which is arranged close to the drain signal line DL on which the disconnection occurs, is cut at a portion thereof close to the counter voltage signal line CL so as to terminate the electrical ~~electric~~ connection between this portion of the counter electrode CT and the counter voltage signal line CL. To be more specific, the portion of the counter electrode CT, which is disposed between the extension portion CTE, which is formed on the counter electrode CT, and is close to the counter voltage signal line CL and the counter voltage signal line CL, is divided.

no ¶ Cutting or dividing of the counter electrode CT can be easily performed using the scanning of laser beams, for example.

Next, laser beams are radiated to a portion of the drain signal line DL which overlaps ~~is overlapped to~~ the extension portion CTE formed on the counter electrode CT close to the counter voltage signal line CL so as to establish an electrical ~~the electric~~ connection between the drain signal line DL and the extension portion CTE. That is, due to the radiation of the laser beams, a hole is formed in the drain signal line DL and the insulation film GI arranged below the drain signal line DL; and, at the same time, due to the melting of the ~~a~~ material of the drain signal line DL, the material is adhered to the extension portion CTE so that an electrical ~~the electric~~ connection is established between the drain signal line DL and the extension portion CTE ~~is established~~.

Further, laser beams are radiated also to a portion of the drain signal line DL which overlaps the other ~~is overlapped to another~~ extension portion CTE formed on the distal end portion (portion remote from the counter voltage signal line CL) of the counter electrode CT so as to establish an electrical ~~the electric~~ connection between the drain signal line DL and the extension portion CTE.

Here, it is not always necessary to perform the above-mentioned three operations in the above-mentioned order; rather, ~~and~~ the order may be arbitrarily determined.

After performing such an operation, the counter electrode CT which is arranged close to the drain signal line DL, which

~~is~~ was disconnected, loses ~~the~~ its function ~~thereof~~ and functions as a bypass of the drain signal line DL. Accordingly, the drain signal line DL is repaired.

In this case, a region A which is disposed between the existing counter electrode CT, which function as the bypass, and the pixel electrode PX, which is arranged close to the counter electrode CT, loses ~~a~~ its pixel display function. However, this region is considered ~~as~~ to be an extremely small region compared to the ~~whole~~ remaining regions ranging from the region B to the region H, where the normal display is performed, and, hence, it is possible to ~~suppress~~ maintain the pixel region to a state which hardly affects the display.

Embodiment 2.

Fig. 4(A) is a plan view showing another embodiment of ~~the~~ a pixel of the liquid crystal display device according to the present invention. ~~Further,~~ Fig. 4(B) is a cross-sectional view taken along a line b-b in Fig. 4(A).

~~Fig. 4(A) corresponds to Fig. 1(A).~~ The constitution which makes this embodiment different from the embodiment shown in Fig. 1(A) lies in the fact that, first of all, the counter electrode CT, which runs in the y direction at the center of the pixel region (the counter electrode CT excluding at least the counter electrodes CT which are arranged close to the drain signal lines DL) is formed on an upper surface of the protective film PAS. Further, the counter electrode CT which is formed on the upper surface of the protective film PAS is integrally formed

with a grid-like conductive layer, which is formed on the protective film PAS such that the conductive layer covers the gate signal lines GL and the drain signal lines DL.

To enhance the numerical aperture of the pixel, for example, the conductive layer is made of a light transmitting material such as ITO (Indium Tin Oxide), ITZO (Indium Tin Zinc Oxide), IZO (Indium Zinc Oxide), SnO_2 (zinc oxide), In_2O_3 (indium oxide) or the like. Accordingly, in this specification, the conductive layer ~~be~~ will be referred to as a "light transmitting conductive layer TCL" hereinafter.

The light transmitting conductive layer TCL, which is formed so as to cover ~~such that the light transmitting conductive layer TCL covers~~ the gate signal lines GL and the drain signal lines DL, is configured so as to make the electric field that is generated in response to respective signals supplied to the gate signal lines GL and the drain signal lines DL terminate thereto. This is because, ~~that~~ when the electric field is terminated to the pixel electrode PX, this gives rise to the generation of noise, ~~noises~~ thus degrading the quality of the display. Accordingly, the light transmitting conductive layer TCL, which is formed in a grid pattern, has a center axis thereof substantially aligned with the center axes of the gate signal line GL and the drain signal line DL, and, at the same time, the light transmitting conductive layer TCL has a large width.

Further, such a light transmitting conductive layer TCL is configured to ~~have a~~ function as ~~of~~ a counter voltage signal

line which supplies counter voltage signals to the counter electrodes CT ~~which is~~ that are integrally formed with the light transmitting conductive layer TCL. Accordingly, it is also possible to ~~have~~ achieve an advantageous effect in that the total electric resistance value of the light transmitting conductive layer TCL together with the counter voltage signal line CL can be reduced.

Further, due to such a ~~constitution~~ feature, the protective film PAS is constituted of a sequential laminated body particularly consisting of a protective film PAS1 that is formed of an inorganic material layer, such as silicon nitride film (for example, SiN), for example, and a protective film PAS2 that is formed of an organic material layer made of resin, for example. This constitution is provided for reducing the dielectric constant of the protective film PAS as a whole so as to reduce the parasitic capacitance between the light transmitting conductive layer TCL and the gate signal line GL or the drain signal line DL.

Also, in the above-mentioned constitution, the counter electrode CT, which is formed close to the drain signal line DL is, in the same manner as the constitution described with reference to ~~in~~ the embodiment 1, that is, as shown in Fig. 5A corresponding to Fig. 4A, provided with extension portions CTE which overlap ~~are overlapped to~~ the drain signal line DL at a portion of the counter electrode CT close to the counter voltage signal line CL and at the distal end portion of the counter electrode CT.

Also in this case, it is possible to repair the drain signal

line DL in the same ~~order~~ manner as shown in Fig. 3A and Fig. 3B.

Here, in the above-mentioned embodiment, the signal line which runs in the x direction at the center of the pixel region is formed as the counter voltage signal line CL. However, it is needless to say that this signal line may be formed as the capacitance signal line CPL.

A connection portion of the pixel electrode PX, which is constituted of a group of electrodes consisting of two electrodes, for example, is positioned above the capacitance signal line CPL, and a capacitance element Cstg which uses an insulation film GI as a dielectric is formed between the capacitance signal line CPL and the connection portion.

In this case, an electrode (corresponding to the counter electrode CT in Fig. 4A) which is arranged close to the drain signal line DL and is connected to the capacitance signal line (corresponding to counter voltage signal line CL in Fig. 4A) is configured to function as a shield electrode, which terminates the electric field from the drain signal line DL and also is configured to function as a bypass line at the time of ~~repairing~~ repair.

Embodiment 3.

Fig. 6A is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig 6B is a cross-sectional view taken along a line b-b in Fig. 6A.

~~Fig. 6(A) corresponds to Fig. 4(A).~~ The constitution

which makes this embodiment different from the constitution shown in Fig. 4(A) lies in the fact that notched portions CUT are formed in portions of the light transmitting conductive layer TCL, which is integrally formed with the counter electrode CT formed on the upper surface of the protective film PAS.

That is, the notched portions CUT are formed in the light transmitting conductive layer TCL at portions thereof arranged above the drain signal line DL and ~~overlapped to~~ overlap the extension portions CTE of the counter electrode CT close to the drain signal line DL, such that the extension portions CTE are exposed from the light transmitting conductive layer TCL.

Due to such a constitution, as shown in Fig. 7A, which corresponds to Fig. 6A, at the time of repairing the disconnection of the drain signal line DL, the light transmitting conductive layer TCL is not formed at the portions to which laser beams are radiated.

Accordingly, it is possible to obtain an advantageous effect that the repairing of the disconnection can be surely performed even after the light transmitting conductive layer TCL is formed. That is, it is possible to structurally eliminate the possibility that the extension portions CTE of the extension portion CTE or the drain signal line DL and the light transmitting conductive layer TCL are short-circuited at the time of repairing the disconnection using laser beams. This advantageous effect is obtained when the extension portions CTE of the counter

electrode CT are notched at crossing portions of the extension portion CTE and the drain signal line DL. Accordingly, in the constitution where the line or electrode has an overlapped position below the drain signal line DL by way of an insulation film and a conductive layer is formed above the drain signal line DL by way of an insulation film corresponding to the overlapped portion, it is possible to repair the ~~achieve repairing of~~ disconnection by providing a notch or a rectangular removal pattern ~~to~~ in the conductive layer. Further, as the notch or the rectangular removal pattern, when the conductive layer remains, it is possible to hold the ~~electric~~ electrical connection around the overlapped position, and, hence, it is possible to ~~hold~~ maintain a shielding ~~effect~~ of a leaked electric field from the drain signal line DL due to the light transmitting conductive layer TCL in the major region of the drain signal line DL, other than the overlapped position.

In view of the above-mentioned concept of this embodiment, it is needless to say that the notched portions CUT are formed as hole portions. This is because ~~that~~ it is sufficient to have a pattern in which the light transmitting conductive layer TCL is not formed at portions to which laser beams are radiated.

Here, it is needless to say that, also in this embodiment, the counter voltage signal line CL is formed as the capacitance signal line.

Embodiment 4.

Fig. 8(A) is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 8(B) is a cross-sectional view taken along a line b-b in Fig. 8(A). ~~Fig. 8(A) corresponds to Fig. 4(A).~~

~~Different from~~ As opposed to the embodiment shown in Fig. 4(A), repairing of a disconnection of the drain signal line DL is not taken into consideration in this embodiment. That is, this embodiment provides ~~the~~ a constitution which facilitates repairing of short-circuiting which is generated between the drain signal line DL and the gate signal line GL via a through hole or the like formed in the insulation film GI, that is formed as a layer below the drain signal line DL at the time of forming the drain signal line DL.

That is, a slit SLT which is arranged parallel to the running direction of the gate signal line GL is formed in a portion of the gate signal line GL which crosses the drain signal line DL. The slit SLT is formed ~~with~~ to have a length which allows the slit to sufficiently extend ~~stride~~ over the drain signal line DL.

Then, in the light transmitting conductive layer TCL, which is integrally formed with the counter electrode CT on an upper surface of the protective film PAS2, at a portion where the gate signal line GL crosses the drain signal line DL, a hole portion OH, which has a larger extension than the portion, is formed.

In other words, this embodiment is configured such that

the hole portion of the light transmitting conductive layer TCL is formed such that the hole portion sufficiently exposes the portion where the gate signal line GL crosses the drain signal line DL ~~and~~, so that the repairing of a short-circuit~~ing~~ using laser beams is facilitated by this portion.

That is, as shown in Fig. 9, corresponding to Fig. 8(A) ~~(drawing corresponding to Fig. 8(B) being omitted)~~, when a short-circuiting (indicated by "x" in the drawing) occurs ~~is generated~~ between the drain signal line DL and the gate signal line GL via the insulation film GI that is formed below the drain signal line DL at the time of forming the drain signal line DL, the laser beams are scanned from both ends of the slit SLT to ~~one~~ the side portions of the respective gate signal lines GL, so that a portion of the gate signal line GL which is short-circuited with the drain signal line DL is electrically isolated.

In this case, since the light transmitting conductive layer TCL is not formed at the portion which the laser beams scan, it is possible to easily repair the short-circuiting even after the formation of the light transmitting conductive layer TCL.

Embodiment 5.

Fig. 10(A) is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 10(B) is a cross-sectional view taken along a line b-b in Fig. 10(A).

~~Fig. 10 corresponds to Fig. 8.~~

The constitution which makes this embodiment different from the embodiment shown in Fig. 8A lies in the fact that, with respect to portions which are repaired by the scanning of laser beams, the hole portions POH are formed not only in the light transmitting conductive layer TCL, but also in the protective film PAS2 that is arranged below the light transmitting conductive layer TCL.

In this case, at the time of forming the light transmitting conductive layer TCL, in order to prevent a material of the light transmitting conductive layer TCL from being formed on the side wall surfaces of the protective film PAS2, the hole portions OH of the light transmitting conductive layer TCL are formed to be larger than the hole portions POH that are formed in the protective film PAS2.

This provision is ~~made~~ adopted so as to sufficiently achieve the parasitic capacitance reduction effect between the light transmitting conductive layer TCL and the drain signal line DL due to the protective film PAS2 formed of an organic material.

Further, when the light transmitting conductive layer TCL is arranged at the side face, the probability of occurrence of short-circuiting at the time of repairing using laser beams is increased. This provision is made to structurally eliminate such a possibility.

Compared to the protective film PAS1 which is formed of ~~the~~ an inorganic film, since the protective film PAS2 is formed of an organic film, the protective film PAS2 is liable to be easily dissolved, evaporated or diffused due to heat generated

by the laser beams. When the evaporation or the diffusion of the protective film PAS2 occurs at the time of performing repairing using laser beams, although the lines may be repaired, they contaminate the liquid crystal, thus generating new minute defective regions, and, hence, ~~the~~ a complete repair ~~repairing~~ cannot be obtained. Accordingly, to obtain ~~the~~ a structure in which ~~can~~ repair of the lines can be achieved more reliably, regions for removing the protective film PAS2 are formed as the hole portions POH in the opening portions of the hole portions OH. Due to such a constitution, at the time of repairing the lines using laser beams, it is possible to obviate the occurrence of secondary defects attributed to the above-mentioned protective film PAS2.

Embodiment 6.

Fig. 11(A) is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. Further, Fig. 11(B) is a cross-sectional view taken along a line b-b in Fig. 11(A).

~~Fig. 11(A) is a view which corresponds to Fig. 4(A).~~

The constitution which makes this embodiment different from the embodiment shown in Fig. 4(A) lies ~~in~~, first of all, in the fact that the counter voltage signal lines CL and the counter electrodes CT, which are integrally formed with the counter voltage signal lines CL, are not formed. That is, the counter electrodes CT are formed on an upper surface of the protective film PAS2 and are integrally formed with a light transmitting

conductive layer TCL, which is formed such that the light transmitting conductive layer TCL covers the gate signal lines GL and the drain signal lines DL.

In this case, the light transmitting conductive layer TCL which covers the drain signal lines DL has a shielding function with respect to the drain signal lines DL and, at the same time, functions as the counter electrode CT. That is, portions of the light transmitting conductive layer TCL which are projected into the inside of the pixel region from the drain signal line DL ~~performs~~ function ~~of~~ as the counter electrodes CT, ~~which generate~~ and an electric field is generated between ~~the~~ such counter electrode CT and the pixel electrode PX arranged close to the counter electrode CT.

Then, the signal lines which run in the x direction at ~~the~~ approximately the center portion of the pixel region are constituted as capacitance signal lines CPL, and these capacitance signal lines CPL are formed simultaneously with the formation of the gate signal lines GL.

Further, the capacitance signal line CPL is, as shown in Fig. 15, electrically connected to the above-mentioned light transmitting conductive layer TCL over the protective film PAS2 via the contact portions CNT in regions outside the liquid crystal display portion AR. That is, the capacitance signal line CPL is configured so as not to be connected with the contact portions CNT within the pixel region. Here, the contact portion CNT is formed of a hole which sequentially penetrates or passes through the

protective film PAS2, the protective film PAS1 and the insulation film GI.

Above the capacitance signal line CPL, there is a connection portion or bridging between the pixel electrodes PX consisting of a group of two electrodes ~~is positioned~~, and a capacitance element Cstg is formed, which uses an insulation film GI as a dielectric between the capacitance signal line CPL and ~~the~~ this connection portion.

In such a constitution, at a portion where the capacitance signal line CPL and the drain signal line DL cross each other, a slit SLT is formed such that the slit SLT extends ~~strides~~ over the drain signal line DL.

In this case, as shown in Fig. 12, which corresponds to Fig. 11(A), when short-circuiting occurs ~~is generated~~ between the drain signal line DL and a portion of the capacitance signal line CPL (indicated by a mark × in the drawing) at the time of forming the drain signal line DL, laser beams are scanned from both ~~respective~~ ends of the slit SLT to one side of the capacitance signal line CPL so as to form the notch.

Accordingly, it is possible to electrically isolate the portion of the capacitance signal line CPL which is short-circuited with the drain signal line DL, thus achieving the required repair.

Embodiment 7.

Fig. 13(A) is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the

present invention. ~~Further,~~ Fig. 13(B) is a cross-sectional view taken along a line b-b in Fig. 13(A).

~~Fig. 13(A) is a view which corresponds to Fig. 11(A).~~

The constitution which makes this embodiment different from the embodiment shown in Fig. 11(A) lies in the fact that, at crossing portions of the capacitance signal line CPL and the drain signal lines DL, the hole portions OH which surround the crossing portions and peripheries thereof are formed in the light transmitting conductive layer TCL, which is formed on the upper surface of the protective film PAS2. In other words, at the crossing portions of the capacitance signal line CPL and the drain signal lines DL, the light transmitting conductive layer TCL is configured such that the light transmitting conductive layer TCL is not formed on the crossing portions and the peripheries thereof.

Due to such a constitution, after forming the counter electrodes CT and the light transmitting conductive layer TCL, which is formed integrally with the counter electrodes CT, it is possible to easily perform repair~~ing~~, as described ~~in~~ with reference to the embodiment 6.

Embodiment 8.

Fig. 14(A) is a plan view showing another embodiment of the pixel of the liquid crystal display device according to the present invention. ~~Further,~~ Fig. 14(B) is a cross-sectional view taken along a line b-b in Fig. 14(A).

~~Fig. 14(A) is a view which corresponds to Fig. 13(A).~~

The constitution which makes this embodiment different from the embodiment shown in Fig. 13(A) lies in the fact that, at the crossing portions of the capacitance signal line CPL and the drain signal lines DL, the hole portions POH are formed not only in the light transmitting conductive layer TCL, but also in the protective film PAS2. In other words, at the crossing portions of the capacitance signal line CPL and the drain signal lines DL, the light transmitting conductive layer TCL is configured such that the protective film PAS2 and the light transmitting conductive layer TCL are not formed on the crossing portions and the peripheries thereof.

Due to such a constitution, the protective film PAS2, which is formed of an organic material layer, is not also formed at portions to which the laser beams are scanned for repairing, and, hence, there arises no drawback attributed to melting of the protective film PAS2 ~~thus~~. Thus, it is possible to achieve ~~the~~ a reliable repairing.

The above-mentioned embodiments may be used in a single form or in combination. This is because ~~that~~ the advantageous effects of the respective embodiments can be obtained in a single form or in a ~~coupled~~ combined manner.

As can be clearly understood from the above-mentioned explanation, ~~according to~~ with the liquid crystal display device according to the present invention, it is possible to easily

perform repair and to realize ~~the~~ an enhancement of the yield rate.